

**STATEMENT OF WORK AMENDMENT
ACOE INTERAGENCY AGREEMENT NO. DW-96-9459-1301-0
PHOSPHATE MINING INITIATIVE
JANUARY 2003**

Purpose

The purpose of the Interagency Agreement (IAG) amendment is to provide further technical direction to the Army Corps of Engineers (ACOE) pursuant to IAG No. DW-96-9459-1301-0 to assist the Environmental Protection Agency (EPA) in the assessment of potential risks posed by elevated radium levels in developed areas overlying former phosphate mining sites in Florida. The assessment process includes a phased approach that incorporates varying investigative techniques intended to determine the extent of elevated radium levels relative to naturally occurring background levels. This assessment approach is based on an iterative approach that utilizes screening techniques to cover large areas at comparatively lower costs, followed by progressively more sensitive monitoring techniques as the study area is refined.

The Corps is tasked with procuring the necessary technical support to conduct these assessments, conducting the assessment work, and reporting the results to EPA. In addition to the characterization efforts, another significant component of this project will be the involvement of the State and local municipalities, community, media, and industry in this work. EPA will take the lead in this work through its Community Involvement (CI) Program. However, the Corps may be tasked with providing technical support and/or logistical support to assist EPA in the implementation of its CI Program.

The first phase of work is intended to primarily focus on former mining areas that have since been developed. Some overlap of study areas that include either active mines, or former mines that have not been developed, may occur. It is intended that the majority of investigative work relating to current and/or undeveloped mines will occur through an Interagency Agreement.

Background

As a result of the Government Accounting Office (GAO) review of the United States Environmental Protection Agency's backlog of sites in its Comprehensive Environmental Response, Compensation List (CERCLIS) database in 1999, the South Site Management Branch (SSMB), Waste Management Division, Region 4, discovered it had a significant number of phosphate mining related sites in the Region. For the purposes of this strategy, the term "phosphate mining sites" will be used generically, and may include former and currently operating phosphate mines, phosphate ore processing areas, and chemical plants.

A review of CERCLIS data indicates that there are 21 phosphate mining sites in CERCLIS. The majority of these sites were discovered in 1979 and 1980. Preliminary Assessments were completed on the majority of sites by the State of Florida of sites in during the



early- to mid-1980's. EPA conducted Site Inspections on most of the sites in the late-1980's and early-1990's. Site Inspection Prioritizations were conducted by EPA for most of the sites in the mid-1990's. Many of the sites evaluated have preliminary Hazard Ranking System (HRS) Scores higher than the 28.50 threshold. Only one site has progressed to the Expanded Site Inspection (ESI) stage. Results from this study ESI were used to develop a preliminary HRS Score. This score was well above the threshold for inclusion on the National Priorities List (NPL).

SSMB reviewed several factors that needed to be considered in addressing phosphate mining sites in a briefing paper titled the *Florida Phosphate Mining Initiative, March 2002*. The factors reviewed were the following: Regulatory Authority; Naturally Occurring Radioactive Materials (NORM) versus Technology Enhanced Naturally Occurring Radioactive Materials (TENORM); Risk Assessment Methodologies; NPL versus Superfund Alternative Sites; Mega Sites; and potential public and Industry concerns.

It is important for EPA to develop a well planned approach that addresses all relevant issues and balances all relevant concerns. Because the primary threat posed by phosphate mining sites is the potential exposure to gamma radiation and radon gas emissions (particularly if sites are utilized for home construction), there is a high potential for unduly alarming the public and industry. It is important to develop a strategy that accurately identifies and addresses the potential threat and risks from potential exposure to gamma radiation relative to exposure from other sources to radiation.

A review of the phosphate mining sites in the south-central Florida area indicates that they can be placed in two broad categories with many similar, but also unique characteristics: 1) former phosphate mining sites that have since been developed into commercial/industrial, agricultural, recreational, and residential areas; 2) undeveloped current and former phosphate mining sites.

First category of sites include former mining areas that have since been closed and are now developed. These are generally older mines that were operated in the late-1800's and early- to mid-1900's. Mining operations that occurred at these sites were similar to current mining operations, but were generally less sophisticated and less efficient. As a result of being less efficient, these sites have the potential for exposing and leaving greater quantities of radium laden phosphate ore near the surface. Therefore, elevated radium levels and associated radon may occur, not only in the former processing areas, but in some of the former mining areas as well.

To aid in the location and assessment of these former phosphate mining sites where development has occurred, a GIS based survey of former mining areas and developed areas in the western portion of Polk County, Florida was initiated by the Corps. This project involved the procurement of all available information to locate former mining operations and superimposing this information on aerial photographs for the County. This exercise revealed numerous areas of residential and commercial development over former mining areas. This initial assessment was limited to the western portion of Polk County where some of the oldest mining operations

occurred. Additional houses may be identified as other portions of Polk, Hillsborough, Hardee, and Manatee counties are mapped.

The second category of sites are primarily sites in various stages of operation and closure. These sites typically encompass thousands of acres and may include mined areas, waste disposal areas, plant processing areas, or any combination thereof. Based on a review of industry literature, disposal and processing areas are expected to have the highest levels of radium and gamma radiation, plus radon gas emissions. Comparatively, based on current mining and mine closure practices, significantly lower levels of radium are left exposed at the mine. Hence, gamma radiation levels in the vicinity of former mining areas should be generally consistent with background levels. Elevated levels of radiation at the mandatory closure mines are expected to mainly occur in the vicinity of former process areas.

Conceptual Approach

This project includes a multi-phased approach that relies on an iterative process of data collection designed to progressively improve the quality of data as the extent of the study area is identified and refined. Based on initial estimates of the extent of former phosphate mines that are not subject to the State of Florida's mandatory closure requirements established in 1975, there is approximately 142,000 acres (221 square miles) of land in Central Florida that has been mined and could have been developed. Residential development of the land has the potential for causing the greatest degree of exposure and potential risk to human health and will thus be the focus of this study. Initial estimates from census data indicate that as much as 20,000 acres may have been developed for residential purposes. This estimate will be refined as this project proceeds and additional information is collected.

The first phase of this study will be the location of residential areas that have been built over former phosphate mining areas through readily available data sources such as historical aerial photographs, parcel maps, census data, etc. FDEP has provided EPA with an ARCVIEW based system that is a thorough compilation of information regarding the location of current and former mines, mine status, ecological systems, populations, and property ownership. EPA is in the process of supplementing this database with additional population data.

Areas of residential development over former mines will then serve as the basis for conducting the first phase of radiation monitoring. This first phase of monitoring will be conducted using remote sensing techniques intended to identify areas of potential concern that will be further assessed using progressively more sensitive monitoring techniques. It is envisioned that the end product will be a GIS and/or ARCVIEW based system that maps gamma radiation in residential areas that overly former phosphate mines.

This information will then serve as a basis for EPA, in consultation with the State of Florida and other appropriate Agency's to make a determination regarding the extent and magnitude of potential exposures and risks.

Task 1 - Project Planning and Reporting

This Task will include the collection and review of relevant background information and the development of the appropriate planning documents. The Corps has been providing assistance to EPA in the support for phosphate related projects through other existing IAG's and should, therefore, have a good understanding of the nature of the problem. Some additional work may be required to help in the procurement and evaluation of appropriate data collection methodologies and contractor procurement.

The Corps will submit a Work Plan (WP) for EPA review and approval that addresses the tasks outlined herein. The WP will address a methodology for accomplishing the technical requirements of this SOW as well as the budget required for implementation of the work. The WP will include, or provide for the subsequent submittal of a Quality Assurance Plan and Health and Safety Plan for tasks that involve the collection and management of data. The WP will also include a budget that outlines the hours and cost associated with performing Tasks 1 - 3. Since Tasks 4 and 5 will be based on the results from the work performed in the preceding Tasks, a budget cannot be developed at this time. The WP will be modified, as appropriate, through the submittal of a Sampling and Analysis Plan/Field Operations Plan as Tasks are performed that require data collection and analyses.

The Corps should plan to participate in at least two project planning meeting, one at the EPA Regional office in Atlanta and one in the vicinity of Lakeland, Florida.

With regard to reporting requirements, the Corps will submit a monthly progress report that reports the progress of the previous month, any concerns/issues EPA should be aware of, and a summary of the expenditures of the prior month and the cumulative expenditures of the project.

Task 2 -Mapping of Residential Areas Overlying Former Phosphate Mines

At this time, EPA will take the lead in the mapping of residential areas that have been developed over former phosphate mines. The database provided by FDEP currently provides the location and boundaries of former phosphate mines that ceased operations prior to June 1975 and did not have any associated state mandated closure requirements. EPA is currently gathering additional population data from sources such as historical aerial photographs, parcel maps, and census data. This data will then be merged with the mine location information in an effort to generate maps that identify residential areas that overlie form mines. For the purposes of this project, residential areas will be defined broadly to include single-family and multi-family dwellings, current dwellings and planned developments, and mixed use developments. Former mines will be defined as the mine proper, in addition to ore processing areas, phosphate rock storage areas, and waste disposal areas.

Residential areas that are identified that overlie former phosphate mines will be assumed to represent those areas with the highest potential for elevated levels of gamma radiation present in

the soil. It will be these areas that will be targeted for further assessment of actual gamma radiation levels. The location of these areas will be documented through both maps and geo-referenced coordinates.

While EPA will have the lead in performing this task, the Corps may be tasked to assist EPA in the collection and analysis of some of the information. The scope and cost of this work will be agreed to by EPA and the Corps as the work is identified.

Task 3 - Screening Assessment of Gamma Radiation Levels

The first phase of gamma radiation assessment will be conducted using aerial based remote sensing techniques. It is envisioned that aircraft based radiation monitoring equipment will be used to map gamma radiation levels for those areas identified in Task 1. This task will result in the development of radiation contour maps and data in a format that can be integrated by EPA into its GIS/ARCVIEW database. As a minimum, EPA should be able to use this information to prepare an overlay of radiation levels that correspond to the location of residential developments and former phosphate mines.

The measurements should be reported in micro roentgens per hour ($\mu\text{r/hr}$) and should correspond with doses an adult would receive at ground level. The monitoring should be designed in a way so as to be able to measure gamma radiation levels that exceed $20 \mu\text{r/hr}$. Each measurement should be representative of an area of one acre or less in size. Another important consideration in the development of the sampling protocol is the minimization of the effect the monitoring could have on the public.

Since by definition, the study area will primarily be performed in residential areas, the flying of aircraft over homes at low-heights has the potential to cause significant concern within the community. All efforts will be taken to minimize any concern and disruption of activities within the community. Ensuring public safety will also be a primary concern in the development of the monitoring protocol. While the minimum flying height will be 150-feet, efforts should be taken through initial field measurements to determine if this height can be increased without decreasing the sensitivity of the monitoring such that the individual measurements exceed a representativeness of one-acre in size.

Task 4 - Ground-Based Radiation Survey Measurements

The goal of this task will be to 1) verify the presence of an area of potential concern using monitoring equipment with greater sensitivity and 2) identify and delineate areas of potential concern one-quarter acre or less in size. It is anticipated that results from the aerial gamma radiation survey will identify areas of potential concern (i.e., gamma radiation levels in excess of $20 \mu\text{r/hr}$) that will need further investigation to better locate and delineate the extent of the radiation source. It is envisioned that this effort will use a combination of ground-vehicle based field monitoring equipment and hand-held monitoring equipment to conduct this second phase of

monitoring.

As with Task 3, this task will result in the development of radiation contour maps and data in a format that can be integrated by EPA into its GIS/ARCVIEW database. As a minimum, EPA should be able to use this information to prepare an overlay of radiation levels that correspond to the location of residential developments and former phosphate mines.

At this time the scope of this task is unknown. The number and location of samples will be dependant on the results from Task 3 and will, therefore, be determined at a later date. However, for cost estimating purposes, a price per unit cost should be included for measurement of gamma radiation levels using ground-based instruments.

Task 5 - Radiation Measurements Through Environmental Sampling

It is envisioned that results from the ground-based radiation monitoring in Task 4 will further identify and delineate areas of potential concern that may warrant further characterization to fully determine the extent of the potential risks. Task 5 is intended to delineate discrete areas where the potential risks to exposures to gamma radiation can be further assessed through the collection of soil and indoor air samples. The primary soil criterion under consideration at this time is 5 picocuries per gram (pCi/g) of Radium 226 (Ra^{226}) above background as an indicator of unacceptable risks level. With regard to indoor exposures, a level of 20 $\mu\text{r/hr}$ above background would be considered an unacceptable exposure level.

At this time the scope of this task is unknown. The number and location of samples will be dependant on the results from Task 4 and will, therefore, be determined at a later date. However, for cost estimating purposes, a price per unit cost should be included for the collection and analysis of soil samples for Ra^{226} and indoor air radiation measurements.

Data from this task will be summarized in Tables and along with the plotting of Ra^{226} concentrations in soil and indoor radiation measurements. The data shall also be geo-referenced and presented in an electronic format that can be integrated by EPA into its GIS/ARCVIEW database.

Task 6 - Reporting

As a minimum, data collection activities outlined in Tasks 3-5 will be summarized in a report. A draft of the report will be submitted to EPA for review no later than 45 days after the completion of the data collection activities. The report will summarize the scope of work performed, data collection locations, and results, and conclusions. A final report will be submitted to EPA within 15 days of receipt of EPA's comments. Unless otherwise requested, 10 copies of each submittal will be provided to EPA.